Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Inquiry Regarding Carrier Current Systems, including Broadband over Power Line Systems	)	ET Docket No. 03-104
	)	
	)	
	)	

To: The Commission

July 7, 2003

COMMENTS OF GERALD W. MURRAY, WA2IWW

I. BACKGROUND

My name is Gerald W. Murray. I have held Amateur Radio license WA2IWW since 1976, and have held the Amateur Extra class license since 1992. I also hold the following FCC commercial radio operator licenses:

- General Radiotelephone Operator License (GROL) with Ship Radar Endorsement
- Second Class Radiotelegraph Operator's Certificate with Ship Radar Endorsement
- GMDSS Radio Operator/Maintainer License with Ship Radar Endorsement

I am currently employed as a Data Communications Specialist II by the New York State Workers' Compensation Board (NYSWCB). I had previously been employed as a broadcast operator by AM and FM broadcast stations in Upstate New York's Capital District Area.

II. AFFECTED HF/VHF USERS

To date, numerous comments have been filed in this proceeding by amateur radio operators who are very concerned about the inevitable impact of the proposed BPL systems. However, amateur radio is not the only radio service which will be impacted by

the proposal. A quick review of the attached chart, "United States Frequency Allocations", (prepared by the National Telecommunications Information Administration (NTIA)) provides a partial listing of the radio services which presently occupy spectrum space between 2 MHz and 80 MHz

- Aeronautical Mobile
- Aeronautical Radionavigation
- Amateur
- Amateur Satellite
- Broadcasting
- Fixed
- Land Mobile
- Mobile
- Maritime Mobile
- Radioastronomy
- Radiolocation
- Space Research
- Standard Frequency and Time Stations

III. THE FEDERAL GOVERNMENT INTEREST

The Federal government has a strong interest in promoting and protecting the amateur radio service, as well as the protection of its own radio systems. The NTIA's interest in protecting the amateur radio service can be inferred from comments dated August 21, 2002 which the NTIA submitted in FCC Docket 02-98. In these comments, the NTIA states:

> *"The amateur radio service has been important to this nation for many years, and the National Telecommunications Information Administration (NTIA) welcomes the Commission's efforts to provide new allocations to support amateur radio services. Amateur services currently share spectrum with federal users in several bands and have been good spectrum neighbors."*

In the same comment letter, the NTIA also outlines the need for protection of government HF radio systems:

> *"HF bands are currently used extensively by federal agencies for emergency services, including communications support for the Department of Defense, Coast Guard operations, Department of Justice law enforcement, and back-up or emergency uses by twelve other federal agencies."*
>
> *"Federal agencies need immediate access to these HF frequencies in times of emergency."*
>
> *"Some federal agencies utilizing this portion of the HF band have automatic link establish (ALE) systems that sample channels periodically to determine channel availability."*

IV. HIERARCHY OF PROTECTION

The present rules define a hierarchy of protection for various spectrum users. Users of the primary licensed services enjoy the highest level of protection. Below this, users of secondary licensed services enjoy the second-highest level of protection. The third-highest level of protection is accorded to the operators of unlicensed (Part 15) devices. The operators of incidental radiators enjoy little or no protection.

To summarize, the list of radio services (in order of most protection to least protection) is:

- Primary licensed service
- Secondary licensed service
- Unlicensed devices (Part 15, etc.)
- Incidental radiators

Since incidental radiators have the lowest level of protection, they may not cause harmful interference to unlicensed Part 15 devices, secondary users, or primary users. The operators of the incidental radiators are required to take whatever steps are necessary (including the discontinuance of operation) to eliminate harmful interference, as defined by the FCC:

> *Harmful interference. Any emission, radiation or induction that endangers the functioning of a radionavigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunications service operating in accordance with the Radio Regulations.*

V. ARRL STUDIES AND COMMENTS

The ARRL has raised several questions regarding the feasibility of access BPL systems, and the potential for harmful interference. It references some of it's own research, as well as studies performed in other countries, such as the Netherlands and Japan. A copy of the ARRL white paper, "Calculated Impact of PLC on Stations Operating in the Amateur Radio Service" is included as an attachment.

The filings and studies presented or cited by the American Radio Relay League (ARRL) should be given serious consideration. There are several recent examples which validate the work of the ARRL laboratory:

1. The FCC has recognized the qualifications of the ARRL laboratory, and actually references the lab in the standard letters it sends to utilities, owners of electric fences, and operators of Part 15 devices which are believed to be causing harmful interference.

   For example, in a letter dated May 23, 2003, from the FCC to Mr. John W. Rowe,

Chairman, President and Chief Executive Officer of Exelon Corporation of Chicago, IL, the FCC states:

> *"While the FCC has confidence that most utility companies are able to resolve these issues voluntarily, the FCC wants to make your office aware that this unresolved problem may be a violation of FCC rules and could result in a monetary forfeiture for each occurrence. At this stage, the FCC encourages the parties to resolve this problem without FCC intervention, but if necessary to facilitate resolution, the FCC may investigate possible rules violations and address appropriate remedies.*
>
> *The American Radio Relay League, a national organization of Amateur Radio operators, may be able to offer help and guidance about radio interference that involves Amateur Radio operators.*
>
> *American Radio Relay League*
> *Radio Frequency Interference Desk*
> *225 Main Street*
> *Newington, CT 06111*
> *860-594-0200*
> *E-mail: rfi@arrl.org"*

The full text of this letter is included as an attachment. The FCC has used this same language in several recent letters to utility companies and owners of electric fences (incidental radiators), as well as operators of unlicensed Part 15 devices.

2. The FCC has also accepted and acknowledged input from the ARRL in the preparation of OET Bulletin 65 Supplement B, entitled "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields – Additional Information for Amateur Radio Stations".

20 contributors from ARRL (headquarters staff and outside advisors) reviewed an early draft of this document, and provided comments and suggestions. The 20 contributors are listed by name.

3. The ARRL hosted a workshop on power line interference on August 22 and 23, 2002. The approximately 20 attendees included two members of the U.S.

armed forces, a communications specialist, several members of the ARRL headquarters staff, several power company employees, and Riley Hollingsworth, (K4ZDH), the FCC's Special Counsel for Amateur Radio Enforcement. An article on this has been included as an attachment.

VI. EXISTING PLC SYSTEMS

The ARRL has worked with the the HomePlug Powerline Alliance in the development of the HomePlug standard for in-home PLC systems. As part of the HomePlug specification, spectral masks are utilized to protect amateur the bands.

However, this step does have some drawbacks, in that it does not provide relief in the following situations:

- The spectral masks may not be sufficient to prevent all cases of interference to stations in the amateur radio service.
- The spectral masks will not benefit amateur stations operating in the Military Affiliate Radio Service (MARS), government HF users, or other users of the HF spectrum.
- The use of spectral masks does nothing to protect the five new channels which were recently allocated to the amateur radio service on a secondary basis in the 60 meter band (5 MHz). It also does nothing to protect the pre-existing federal government radio systems which are the primary users of this band.
- The implementation of the spectral masks to protect the then-current amateur bands does nothing to protect any new HF or low VHF allocations for the amateur radio service, or for other radio services. This would limit the Commission's ability to reallocate HF spectrum among licensed services when needed. This would place the Commission in an untenable position, as it would not be able to change domestic allocations when needed, or be able to respond to changes in the International HF allocations from the International Telecommunications Union (ITU).

VII. UTILITY DEPLOYMENT OF ACCESS BPL SYSTEMS

Utility companies wishing to deploy access BPL systems would have to accommodate any existing radio services which are located in or near the area to be served. Even if the

situation involving pre-existing stations is completely resolved at the time of the initial installation, future events could cause interference problems which would have to be resolved by the utility which is utilizing access BPL technology. Some of these events would include:

- Deterioration of electrical wiring through normal wear and tear which unbalances (or further unbalances) the power lines with respect to data transmission. The threshold level for the deterioration which would unbalance an access BPL transmission system would be less than the threshold level for deterioration which would cause standard power line interference, and far less than the threshold for causing problems with the actual delivery of electrical power.

- One or more individuals living in or near the served area may choose to take up amateur radio

- An inactive amateur radio operator living in or near the served area may become active

- An amateur radio operator who holds a codeless Technician class license could suddenly gain HF privileges by passing examinations for upgrade to Technician HF Class (Code Element 1), or to the General Class (Code Element 1 and written Element 3).

- An amateur radio operator could move from an unserved area into a house or apartment in or near the served area.

- A new radio installation may be established in or near the served area for a service other than the amateur radio service.

Although any business venture is a calculated risk, the need to protect licensed radio services may require the utility to withdraw the access BPL service, or take remedial steps which are so expensive as to offset any revenues which the utility would hope to receive from the operation of the access BPL service.

The ARRL white paper cites a case study in which Phonex model PX-421 wireless modem jacks used by TCI cable (now AT&T/Comcast) had to be redesigned and recalled.

IX. METHODS OF PROVIDING INTERNET ACCESS

There are several different methods currently available for the provision of Internet access. All of the current methods have one or more desirable features which act to prevent or limit radiation in the HF and low VHF spectrum. These features include use of balanced lines, use of shielded or fiber optic cable, or non-use of broadband spectrum. Even though each of the pre-existing delivery methods have at least one undesirable feature, the presence of one or more desirable features acts to limit harmful interference. Table I. lists the features matrix for most of the currently available delivery systems, plus the proposed BPL systems.

Table I. Delivery methods for Internet Access (commercial and residential service)

Service Type	Media Type	Balanced Line	Shielding	Fiber	Broadband	Remarks
Standard telephone line/modem	Twisted Pair Cable	yes	**NO**	**NO**	no	The use of balanced lines and the lack of spectral components in HF and low VHF bands tends to limit radiation
ISDN BRI	Twisted Pair Cable	yes	**NO**	**NO**	no	The use of balanced lines and the lack of spectral components in HF and low VHF bands tends to limit radiation
ISDN PRI	Twisted Pair Cable	yes	**NO**	**NO**	no	The use of balanced lines and the lack of spectral components in HF and low VHF bands tends to limit radiation
DS-1 (T1)	Twisted Pair Cable	yes	**NO**	**NO**	no	The use of balanced lines and the lack of spectral components in HF and low VHF bands tends to limit radiation
DS-3	Coaxial Cable	**NO**	Yes	**NO**	**YES**	The shielding of the coaxial cable tends to limit radiation if properly installed and properly maintained.
DS-3	Fiber Optic Cable	N/A	N/A	yes	**YES**	Since fiber optic cable uses light, there is no radiation of RF frequencies
Cable modems	Coaxial Cable	**NO**	Yes	**NO**	**YES**	The shielding of the coaxial cable tends to limit radiation if properly installed and properly maintained. The FCC promulgates rules limiting leakage from cable systems
Cable modems	Fiber Optic Cable	N/A	N/A	yes	**YES**	Since fiber optic cable uses light, there is no radiation of RF frequencies.

Service Type	Media Type	Balanced Line	Shielding	Fiber	Broadband	Remarks
Unlicensed Microwave	Microwave	N/A	N/A	N/A	**YES**	Interference potential limited by Part 15 restrictions on power levels and antenna gain.
Licensed Microwave/ Satellite	Microwave/ Satellite	N/A	N/A	N/A	**YES**	Interference potential limited by use of directional antennas, stringent FCC technical requirements, and a complex licensing and siting process.
BPL Systems	Power Lines	**NO**	**NO**	**NO**	**YES**	**BPL SYSTEMS USE BROADBAND SIGNALS WHICH ARE RICH IN HF AND LOW VHF SPECTRAL COMPONENTS.** **THE BPL SYSTEMS ARE NOT POINT SOURCES, AND WILL RADIATE OVER WHOLE NEIGHBORHOODS AND COMMUNITIES.** **POWER LINES ARE NOT DESIGNED TO BE BALANCED FOR RF. IN PRACTICE, IT IS VERY DIFFICULT TO GET POWER LINES TO BE BALANCED (OR KEEP THEM BALANCED) FOR RF.** **POWER LINES ALSO LACK SHIELDING.**

NOTES:

1. Desirable features which tend to prevent or limit harmful interference are indicated in lower case in black print
2. Undesirable features which cause or contribute to harmful interference are indicated in **UPPER CASE IN RED PRINT**.
3. None of the features of BPL over power lines act to prevent or limit harmful interference

In evaluating the potential for access BPL systems to cause harmful interference to the amateur radio service (and other licensed services), the following real-world factors need to be considered:g

- Commercial power lines represent a very large radiating surface, which can represent an efficient high-gain antenna.
- Signals from the power lines do not constitute a point source, but instead radiate over the entire BPL service area (such as a neighborhood or a whole community)
- Utilities using access BPL and each individual subscriber will be placing signals on the power lines
- Open light switches and other electrical devices will act to unbalance the power line with respect to RF
- Power companies have shown widely varying levels of expertise and compliance with respect to their current obligations under Part 15 to correct harmful interference from incidental radiators. The FCC has written numerous letters over the past few years to utilities after amateur radio operators were unable to obtain a resolution via Customer Service. In one case, the utility proposed to bill the amateur radio operator for the necessary repairs, even though the rules require the utility to correct such problems at its own expense.
- The assumption that the interference at 30 meters distance may be estimated by measuring at 3 meters and extrapolating using an attenuation of 40 dB/decade is seriously flawed. For BPL systems, measurements at both 3 meters and 30 meters would be in the near field.
- FCC rules Sec. 15.31(f)(2) require that "an attempt should be made to avoid making measurements in the near field"
- In some cases, use of the 40 dB/decade attenuation figure may be the only way that some proposed systems may appear to meet the current FCC requirements
- Skywave propagation may cause signals from access BPL systems to travel hundreds or even thousands of miles to cause interference throughout the United States, and even into foreign countries
- Problems with Part 15 devices have caused manufacturers to conduct extensive (or even total) recall of equipment

IX. CONCLUSION

The adoption of BPL technology would have a serious negative impact on the amateur radio service, and on other services which use the HF and low VHF spectrum. Commercial power lines represent large and efficient radiators which often exhibit high gain. This would cause mutual interference between BPL systems and the various radio services.

Part 15 requires that incidental radiators not cause harmful interference to licensed users. The operators of the incidental radiators are required to take whatever steps are necessary to stop the interference, up to and including discontinuing use of devices which cause harmful interference. In past interference cases, individual homeowners have been asked to stop using cordless phones or other devices which cause interference. Manufacturers have had to redesign and recall such devices as television RF amplifiers, and wireless modem devices.

However, in a BPL system, the whole system would cause harmful interference. If the current protection requirements for licensed radio services are maintained, utilities and subscribers would have to take whatever steps are necessary to prevent the interference. Despite the requirements of Part 15, utilities and subscribers would resist requests to discontinue use. The impact on subscribers who lose Internet access or utilities which have to scrap BPL delivery systems would be much more severe than the impact on persons who may have had to trade in cordless phones.

If the current protection requirements are changed, and radio stations in the amateur radio service or other radio services are asked to curtail or discontinue operation to protect the BPL system, this would represent a total reversal of the long-standing practice of

regulating unlicensed systems to protect licensed systems. This would be, in effect, "having the tail wagging the dog".

The irreconcilable conflicts between existing licensed radio services and proposed access BPL systems would cause harmful interference to the radio services, and may also impair the operations of the BPL systems. The proposed implementation of BPL services would not be in the public interest, convenience and necessity, and the Commission should not proceed in this matter.

Respectfully submitted,

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